Packaged Food Mass Reduction Technology Development (PI=Leong)

Completed Technology Project (2012 - 2013)

Project Introduction

The Advanced Food Technology (AFT) project seeks to define a safe, palatable, and nutritious food system to support long duration space missions beyond Low Earth Orbit (LEO). Balancing resources such as water, food preparation time, stowage volume, launch mass, and power requirements is central to defining a functioning food system solution for these missions. Prior AFT work has addressed the need to decrease the mass of the food system, and has recommended means such as reducing the moisture of the food system, increasing the nutrient density of the food system, and streamlining food packaging systems to accomplish this. Building on these recommendations, the objective of this project is therefore to identify technologies required to formulate meal replacement options that would decrease the mass and volume of the food system, as well as decrease the crew time associated with meal preparation. As commercially available meal replacement products are not adequate for NASA needs, this project will proceed by formulating new products that meet the unique requirements of spaceflight beyond LEO. The development of meal replacement options for the packaged space food system will be achieved by: * Aligning previous studies on nutrition and mass savings to compile the nutritional requirements and consumption guidelines for meal replacement beverages and bars. * Developing meal replacement bar(s) meeting nutrition, sensory, and shelf life requirements for space food systems. * Developing meal replacement beverage(s) meeting nutrition, sensory, and shelf life requirements for space food systems. * Assessing the meal replacement system and creating an implementation plan for the meal replacement options. Some accommodations have been made in the product development design to ensure that the project is completed within budget and on schedule. The recipe development of the bars and beverages will baseline from existing commercial bars and beverages rather than starting from new formulas even though significant changes are likely required to meet nutritional needs. Researchers will leverage flavor concepts from existing commercial bar and beverage products. Accelerated shelf life testing will done to assess stability as the project duration is shorter than the desired shelf life. While the ideal sensory evaluation would be a repeated exposure test to ensure acceptability levels were sustained over multiple experiences, the product amounts and the availability of panelists requires a one-time sensory evaluation for each product. Upon the completion of this study, an assessment of representative formulated meal replacement options will be provided to stakeholders, in order to offer an understanding of meal replacement technology and associated mass savings.

Anticipated Benefits

The meal replacement technology developed during this task has applicability to the military and disaster relief agencies -- two organizations that use heavy amounts of shelf stable goods and are required to transport the goods over large distances. The development of nutritious meal replacement bars

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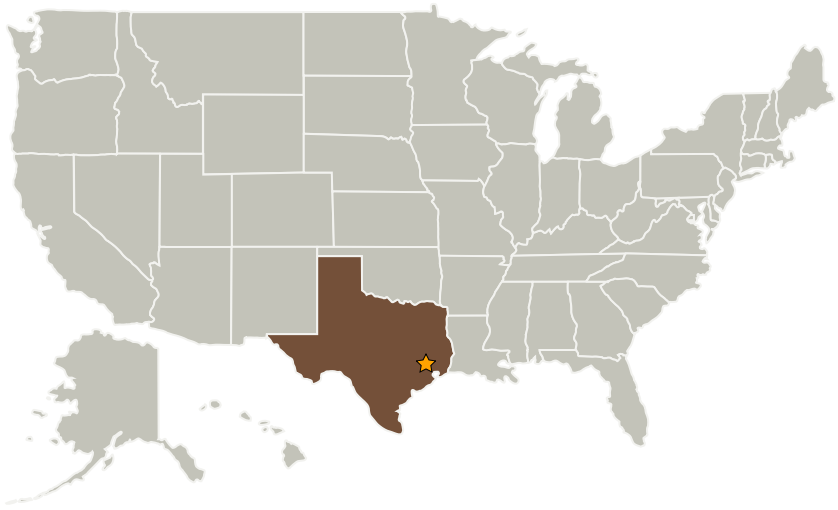
potentially alleviates significant dollars in logistical expenses by providing a lower mass, lower volume pathway to supplying adequate nutrition to the desired populations.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
Lockheed Martin Space Systems(LMSS)	Supporting Organization	Industry	Sunnyvale, California

Primary U.S. Work Locations
Texas

Project Transitions

December 2012: Project Start

Organizational Responsibility

Responsible Mission Directorate:
Space Operations Mission Directorate (SOMD)

Lead Center / Facility:
Johnson Space Center (JSC)

Responsible Program:
Human Spaceflight Capabilities

Project Management

Program Director:
David K Baumann

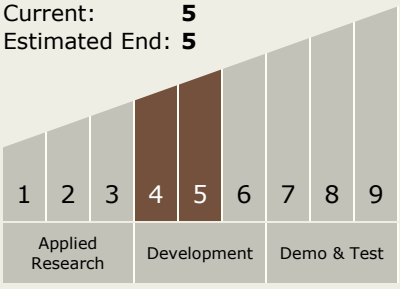
Project Manager:
Grace L Douglas

Principal Investigator:
Monica L Leong

Co-Investigator:
Maya R Cooper

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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October 2013: Closed out

Closeout Summary: The task work began by meal replacement bar and beverage prototypes being developed to meet macronutrient requirements for breakfast and lunch meals, based on current consumption guidelines. Additional food categories were identified as having low nutrient density and commercial food products and new formulations were proposed as replacements. Accelerated shelf life testing was conducted for all products to determine acceptability and general stability. Bars were confirmed to have a 48 to 72 week shelf life while beverages and most category replacements remained stable for 96 weeks. A variety of menus implementing these substitutions in the International Space Station (ISS) Standard Menu were proposed and estimated mass savings ranged from 11%-25%, and packaging savings of 16%-18% when one meal was replaced each day.

Stories

Abstracts for Journals and Proceedings
(https://techport.nasa.gov/file/8925)

Project Website:

https://taskbook.nasaprs.com

Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.3 Human Health and Performance
    - TX06.3.5 Food Production, Processing, and Preservation

Target Destinations

The Moon, Mars